

Appendix 7-2: Summary of CERP Systemwide Evaluation Performance Measures

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SUMMARY

A summary of the Comprehensive Everglades Restoration Plan (CERP) systemwide evaluation performance measures presented in the Draft CERP Systemwide Performance Measures (RECOVER, 2004a) document released on June 18, 2004, is presented in **Table 1**. An asterisk following a title indicates that the performance measure is proposed, but not yet approved. For the natural system, performance measures are principally derived from the conceptual ecological models (CEMs) (Appendix A in RECOVER, 2004b). Others are derived from performance measures used in the Central and Southern Florida (C&SF) Project Comprehensive Review Study (Restudy) [U.S. Army Corps of Engineers (USACE) and South Florida Water Management District (SFWMD or District), 1999]. For urban and agricultural water supply and flood protection objectives, performance measures are based on current federal and state law and policy.

Table 1. Draft CERP systemwide evaluation performance measures.

Number	Title	Source	Evaluation Tool	Target
GE-E1	Number and Duration of Dry Events for Shark River Slough*	Everglades Ridge and Slough CEM stressor C&SF Project Restudy	South Florida Water Management Model (SFWMM)	Natural Systems Model (NSM) version 4.6 envelope for the number of times and mean duration in weeks that water drops below ground in each indicator region.
GE-E2	Inundation Pattern in Greater Everglades Wetlands*	Everglades Ridge and Slough, Southern Marl Prairies, and Big Cypress Regional Ecosystem CEMs stressor C&SF Project Restudy	SFWMM	<p>Ridge and Slough and Sawgrass Plains: NSM 4.6 envelope for number of inundation events and mean duration in weeks of each event for each indicator region.</p> <p>Marl Marsh: Targets for each indicator region are based on observed hydroperiods.</p> <p>Arthur R. Marshall Loxahatchee National Wildlife Refuge (Refuge): Envelope is set in the same way using existing condition (2000B1).</p> <p>Big Cypress: Match NSM 4.6 output indicator region by indicator region (no envelope).</p> <p>Corbett Wildlife Management Area (WMA): Non-NSM target.</p> <p>Rotenberger and Holey Land WMAs: NSM envelopes or non-NSM targets.</p>

Number	Title	Source	Evaluation Tool	Target
GE-E3	Extreme High and Low Water Events in Greater Everglades Wetlands*	Everglades Ridge and Slough, Southern Marl Prairies, and Big Cypress Regional Ecosystem CEMs stressor C&SF Project Restudy	SFWMM	Ridge and Slough, Sawgrass Plains, and Marl Marsh: NSM 4.6 envelope for extreme high and low events and the number. Refuge: Envelope is set in the same way using existing condition (2000B1). Big Cypress: Extreme high water level is +0.25 feet; extreme low water level is -1.0 feet below ground. Rotenberger and Holey Land WMAs: Extreme high water level is +1.5 feet; extreme low water level is -1.0 feet below ground.
GE-E4	Seasonal Amplitude and Interannual Variability of Water Levels in Greater Everglades Wetlands*	Everglades Ridge and Slough, Southern Marl Prairies, and Big Cypress Regional Ecosystem CEMs stressor C&SF Project Restudy	SFWMM	Ridge and Slough/Sawgrass Plains, and Marl Marsh: NSM 4.6 envelope for amplitude of water levels in each indicator region for each water year. Refuge: Envelope is set in the same way using existing condition (2000B1). Big Cypress: Match NSM 4.6 output indicator region by indicator region (no envelope). Corbett WMA: Non-NSM based targets. Rotenberger and Holey Land WMAs: NSM 4.6 envelopes or non-NSM-based targets.
GE-E5	Monthly and Seasonal Overland Flow Volume in Greater Everglades Wetlands*	Total System CEM stressor C&SF Project Restudy	SFWMM	The target is average monthly and seasonal flow volumes across selected transects similar to flows predicted by NSM 4.6.
GE-E6	Species Richness Suitability for Everglades Tree Islands*	Everglades Ridge and Slough CEM stressor	SFWMM	Minimize the deviation from NSM 4.6.
GE-E7	Greater Everglades Wetlands Nutrient (Total Phosphorus [TP]) Concentrations in Surface Water	Everglades Ridge and Slough CEM stressor	Everglades Landscape Model (ELM)	The TP concentration is not to exceed 10 micrograms per liter (µg/L) for both the annual mean concentration at ponded surface water monitoring points and the flow-weighted annual mean at water control structures.
GE-E8	Greater Everglades Wetlands Basinwide TP Loading	Everglades Ridge and Slough CEM stressor	ELM	Targets will be developed for individual basins.
GE-E9	Greater Everglades Wetlands Areal-Based Net TP Loading (Mass/Area)	Everglades Ridge and Slough CEM stressor	ELM	Overland/groundwater net TP loading should not exceed approximately 20 milligrams per square meter per year.
GE-E10	Tracer of Stormwater Treatment Area Bypass Flows	Everglades Ridge and Slough CEM stressor	ELM	The target is to approach 0.0 metric tons per year load of ELM-simulated conservative tracer load into the Everglades, and approach 0.0 mg/m ² /yr tracer load into marshes from canals when bypasses occur.
GE-E11	Periphyton Habitat Suitability Index (HIS) *	Everglades Ridge and Slough, and Southern Marl Prairies CEMs attribute	SFWMM	Increase in aerial coverage of habitats suitable for periphyton and that reflect NSM-based targets for all areas except the LNWR, where the applicable targets are the existing condition (2000 Base).
GE-E12	Alligator HSI*	Everglades Ridge and Slough, Southern Marl Prairies, and Big Cypress Regional Ecosystem CEMs attribute	SFWMM	The target is for the HSI to be within 10% of NSM in all applicable indicator regions except the LNWR, where the applicable targets are future with project (D13R).
GE-E13	Wading Bird HSI*	Everglades Ridge and Slough, Southern Marl Prairies, Everglades Mangrove Estuaries, and Big Cypress Regional Ecosystem CEMs attribute	SFWMM	The number of weeks for which landscape-level suitability (HSI _{land}) is less than or equal to 0.5 during the months of March and April do not exceed the number of weeks predicted by the NSM.

Number	Title	Source	Evaluation Tool	Target
GE-E14	Ridge and Slough HSI	Everglades Ridge and Slough CEM attribute	SFWMM	Restoration of predrainage hydrologic patterns, which requires a time-averaged HSI greater than 0.8.
GE-E15	Tree Island Flooding/Drought HSI*	Everglades Ridge Slough CEM attribute	SFWMM	Minimize deviation from NSM 4.6.
GE-E16	Fish HSI*	Everglades Ridge and Slough CEM attribute	SFWMM	HSI within 10% of NSM result.
GE-E17	Apple Snail Reproduction	Total Systems CEM attribute Modified Water Deliveries Canals and Levees alternatives Interim Structural Operational Plan (ISOP) Draft Interim Operational Plan (IOP)	SFWMM	Water levels will not fall below ground surface prior to May 1 more years than those in the NSM.
GE-E18	Snail Kite Foraging Habitat Vegetation Structure	Total Systems CEM attribute Modified Water Deliveries Canals and Levees alternatives ISOP IOP	SFWMM	Proportionally, at least as much area providing suitable snail kite foraging habitat as the NSM. Areas providing optimal habitat are most desirable.
GE-E20	Long-Legged Wading Birds Foraging Conditions*	Everglades Ridge and Slough, Southern Marl Prairies, Everglades Mangrove Estuaries, and Big Cypress Regional CEMs attribute C&SF Project Restudy	Across Trophic Level Systems Simulation (ATLSS)	Improve total foraging conditions relative to the 2050 base. For implementation runs, the evaluation target is to exceed 2000 base foraging conditions levels.
GE-E21	Short-Legged Wading Birds Foraging Conditions*	Everglades Ridge and Slough, Southern Marl Prairies, Everglades Mangrove Estuaries, and Big Cypress Regional CEMs attribute C&SF Project Restudy	ATLSS	Improve total foraging conditions relative to the 2050 base. For implementation runs, the evaluation target is to meet or exceed 2000 base foraging conditions levels.
GE-E22	White-Tailed Deer Breeding Potential*	C&SF Project Restudy	ATLSS	Improve total breeding potential outside slough areas relative to the 2050 base. For implementation runs, the evaluation target is to meet or exceed 2000 base breeding potential levels.
GE-E23	Alligator Production Index Model*	Everglades Ridge and Slough, Southern Marl Prairies, Everglades Mangrove Estuaries, and Big Cypress Regional CEMs attribute	ATLSS	Improve total alligator production scores relative to the 2050 base. For implementation runs, the evaluation target is to exceed 2000 base production scores.
SE-E1	Surface Water Discharges to Biscayne Bay	Biscayne Bay CEM stressor	SFWMM	<u>Wet/Dry Season</u> Snake Creek: 66,500/93,000 acre-feet (ac-ft) North Bay: 99,000/41,000 ac-ft Central Bay: 161,000/83,000 ac-ft

Number	Title	Source	Evaluation Tool	Target
SE-E2a ¹	Salinity in Florida Bay Coastal Basins Estimated from Upstream Water Stages	Florida Bay CEM stressor	SFWMM	<p>Predicted stages at Gauge NP67 and Gauge P33 that produce lower and upper salinity levels in coastal basins. Stages for lower/higher salinity levels are as follows:</p> <p><u>NP67 Lower/Upper</u> Joe Bay: 2.63 feet/2.04 feet Little Madeira Bay: 2.82 feet/2.02 feet Terrapin Bay: 2.91 feet/1.92 feet Garfield Bight: 2.99 feet/1.97 feet</p> <p><u>P33 Lower/Upper</u> North River Mouth: 7.10 feet/6.20 feet</p>
SE-E2b	Frequency of Low Salinities and High Salinities in Florida Bay Coastal Embayments*	Florida Bay CEM stressor C&SF Project Restudy	SFWMM	<p><u>Lower/Upper Salinity Thresholds</u> Joe Bay: 5/15 ppt Little Madeira Bay: 15/25 ppt Terrapin Bay: 25/35 ppt Garfield Bight: 25/35 ppt North River Mouth: 5/15 ppt</p>
SE-E3	Freshwater Flow to Biscayne Bay from the Miami River	Biscayne Bay CEM stressor Outstanding Florida Water [62-302.700(9), Florida Administrative Code (F.A.C.)] Surface Water Improvement Management SWIM Act [373.453(1)(c)1, Florida Statutes (F.S.)]	SFWMM	<p>In 2050, a total flow discharged through S26+S25B+S25 over a 7-day period of 3,000 ac-ft 80% of the time, and a daily flow rate through S26+S25B+S25 less than 50 cubic feet per second (cfs) (99 ac-ft) less than 10% of the time.</p>
SE-E4	Salinity Patterns in, and Timing of Freshwater Inputs to, Manatee Bay and Coastal Embayments of Barnes Sound	Biscayne Bay CEMs stressor	SFWMM	<p>Wet Season Salinity (June–October): Average salinity within 5–15 ppt in coastal embayments and Manatee Bay, within 15–30 ppt at the mouths of coastal embayments and Barnes Sound, and within 15–30 ppt within Barnes Sound 90% of the wet season.</p> <p>Dry Season Salinity (November–May): Average salinity within 10–19 ppt in coastal embayments and Manatee Bay, within 20–32 ppt at the mouths of coastal embayments and Barnes Sound, and within 20–35 ppt within Barnes sound 90% of the time. Daily average salinity less than 35 ppt at all locations 95% of the dry season.</p> <p>Timing of Flow: Stage and rainfall should show a strong positive correlation, similar to that seen in natural, unimpacted coastal wetlands.</p>

¹ Currently two SE-E2 performance measures are presented in this report. SE-E2a is an interim performance measure that will be replaced by the proposed, SE-E2b once the tools necessary to perform the evaluations are completed.

Number	Title	Source	Evaluation Tool	Target
SE-E5	Reestablish and Maintain Seasonal Salinity Gradients along Portions of Biscayne Bay Shoreline	Biscayne Bay CEM stressor	SFWMM	<p>Wet Season (June–October): Create a persistent positive salinity gradient from freshwater wetlands into the bay with an average bottom salinity of 20 ppt in a zone extending 500 meters from shore. This requires total wet season flows of 321,000 ac-feet during the period November–May. This is an average daily flow of 2,104 ac-feet (1,051 cfs).</p> <p>Dry Season (November–May): Create a persistent positive salinity gradient from freshwater wetlands into the bay with an average bottom salinity of 20 ppt in a zone extending 250 meters from shore. Meeting the dry season salinity target requires total dry season flows of 146,000 ac-feet during the period June–October. This is an average daily flow of 687 ac-feet (346 cfs).</p>
SE-E6	Snake Creek Surface Water Discharges to North Biscayne Bay*	Biscayne Bay CEM stressor	SFWMM	Maintain the salinity downstream of S-29 at water quality station SK 01 at between 5–25 ppt. To achieve this target, the average monthly flow should be maintained between 1,120 ac-ft/month and 41,470 ac-ft/month from the S-29 control structure on Snake Creek Canal (C-9) to north Biscayne Bay.
NE-E1	St. Lucie Salinity Envelope	St. Lucie Estuary and Indian River Lagoon CEM stressor C&SF Project Restudy	SFWMM	Low flow target less than 350 cfs for 207 months. No Lake Okeechobee regulatory discharges. No more than 21 months of mean monthly flows between 2,000 and 3,000 cfs. No more than 12 months of mean monthly flows of greater than 3,000 cfs.
NE-E2	Lake Worth Lagoon Salinity Envelope*	Lake Worth Lagoon CEM stressor	SFWMM	Maintain a salinity envelope of 23–35 ppt, which requires a flow target of 0–500 cfs based on a 14-day moving average.
NE-E3	Caloosahatchee Estuary Salinity Envelope	Caloosahatchee Estuary CEM stressor Chapter 62-303.400, F.A.C.	SFWMM	<p>Freshwater discharges from the C-43 canal at the S79 structure to be maintained between 300–2,800 cfs.</p> <p>Less than 70 months with mean monthly flow less than 300 cfs (basin runoff or S79). Months with low flow should occur in the dry season (November–May).</p> <p>Less than seven months with mean monthly flows greater than 4,500 cfs.</p> <p>Less than 26 months with mean monthly flows greater than 2,800 cfs (local basin runoff). No months with mean monthly flows greater than 2,800 cfs from Lake Okeechobee regulatory releases.</p>
LO-E1	Lake Okeechobee Extreme Low Lake Stage*	Lake Okeechobee CEM stressor	SFWMM	Stage never falls below 10 feet.
LO-E3	Lake Okeechobee Extreme High Lake Stage*	Lake Okeechobee CEM stressor	SFWMM	Stage never rises above 17 feet.
LO-E6	Lake Okeechobee TP Concentrations	Lake Okeechobee CEM stressor	Lake Okeechobee Water Quality Model (LOWQM)	Pelagic TP long-term average below 40 parts per billion (ppb).
LO-E7	Lake Okeechobee Total Nitrogen (TN):TP Ratio	Lake Okeechobee CEM stressor	LOWQM	Pelagic TN:TP long-term average mass ratio higher than 22:1.
LO-E8	Lake Okeechobee Diatom: Cyanobacteria Ratio	Lake Okeechobee CEM stressor	LOWQM	Long-term pelagic carbon mass ratio (diatom:cyanobacteria) above 0.55:1.

Number	Title	Source	Evaluation Tool	Target
LO-E9	Lake Okeechobee Algal Bloom Frequency	Lake Okeechobee CEM stressor	LOWQM	Fewer than 5% of daily chlorophyll a values greater than 40 ppb.
LO-E10	Lake Okeechobee Stage Envelope*	Lake Okeechobee CEM attribute	SFWMM	Gradual stage recession in winter to spring, from approximately 15.5 feet (January) to approximately 12.5 feet (June), followed by a gradual rise in stage from fall to winter, which equates to a target score of 192 feet weeks. Extreme declines in stage to near 11 feet are desirable approximately once per decade.
WS-E1	Frequency of Water Restrictions for Lake Okeechobee Service Area	Section 373.0361(2)(a)(1) F.S.	SFWMM	Provide at least a 1-in-10 level of service as indicated by simulations by the SFWMM in which three or less water years in the 31-year simulation period have water shortages in which significant supply-side management cutbacks are necessary.
WS-E2	Frequency of Water Restrictions for Lower East Coast Service Area	Section 373.0361(2)(a)(1) F.S.	SFWMM	Provide at least a 1-in-10 level of service as indicated three or less water years simulated with regionally significant water shortages in the 36-year evaluation period.
WS-E3	Potential for High Water Levels in South Miami-Dade Agricultural Area	C&SF Project Restudy	SFWMM	Do not exceed the daily stage duration curve taken from the model calibration and validation runs for each of the six indicator cells in the southern Dade area, based on the stage hydrographs from 1983–1993.
WS-E4	Prevent Saltwater Intrusion of the Biscayne Aquifer - Meet MFL Criteria for Biscayne Aquifer	Chapter 40E-8, F.A.C. Section 373.044, F.S. C&SF Project Restudy	SFWMM	<p>Canal at Structure - Minimum Canal Operational Levels Needed to Protect Biscayne Aquifer During Drought Conditions [feet National Geodetic Vertical Datum (ft NGVD)]</p> <p>C-51 at S155 – 7.80 C-16 at S41 – 7.80 C-15 at S40 – 7.80 Hillsboro Canal at G56 – 6.75 C-14 at S37B – 6.50 C-13 at S36 – 4.00 North New River at G54 – 3.50 C-9 at S29 – 2.00 C-6 at S26 – 2.50 C-4 at S25B – 2.50 C-2 at S22 – 2.50</p>
WS-E5	Prevent Saltwater Intrusion of the Biscayne Aquifer in South Miami-Dade County	C&SF Project Restudy	SFWMM	<p>Canal at Structure – Operation Criteria for South Dade Canals to Protect Biscayne Aquifer During Drought Conditions (feet NGVD)</p> <p>C-100A at S123 – 2.00 C-1 at S21 – 2.00 C-102 at S21A – 2.00 C-103 at S20F – 2.00</p>
WS-E6	Comparison of Stage Differences of Water Levels in South Miami-Dade Agricultural Area	Draft IOP	SFWMM	Do not exceed the flood protection/risk that occurred during the ISOP 2001 operations.
WS-E7	Duration and Severity of Water Restrictions in Lake Okeechobee Service Area	C&SF Project Restudy	SFWMM	<p>Frequency: No more than eight months with water shortages during the simulation period.</p> <p>Severity: Total of the severity scores across all years in the simulation be less than or equal to seven.</p>

Number	Title	Source	Evaluation Tool	Target
WS-E8	Duration and Severity of Water Restrictions for Lower East Coast Service Area	Section 373.0361(2)(a)(1), F.S. C&SF Project Restudy	SFWMM	Frequency: No more than 18 months with water shortages during the simulation period. Severity: All water shortages should be Phase 1.

Note: An asterisk (*) following a title indicates that the performance measure is proposed, but not yet approved.

LITERATURE CITED

- RECOVER. 2004a. Draft CERP Systemwide Performance Measures. Restoration Coordination and Verification Team (RECOVER), c/o United States Army Corps of Engineers, Jacksonville District, Jacksonville, FL and South Florida Water Management District, West Palm Beach, FL.
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